



*SCIENTIFIC COOPERATION TO SUPPORT
RESPONSIBLE FISHERIES IN THE ADRIATIC SEA*

MiPAF

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Agriculture
Organization
of the
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of Agriculture
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Forestry
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Adriamed

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Priority Topics Related to Small Pelagic Fishery Resources of the Adriatic Sea

Report of the First Meeting of the Adriamed Working Group on Small Pelagic Resources

Split, 12-13 October 2000

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Preface

The Regional Project “Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea” (Adriamed) is executed by the Food and Agriculture Organization of the United Nations (FAO) and funded by the Italian Ministry of Agriculture and Forestry Policies (MiPAF).

Adriamed was born to contribute to the promotion of cooperative fishery management between the participating countries (Republics of Albania, Croatia, Italy and Slovenia), in line with the Code of Conduct for Responsible Fisheries adopted by the UN-FAO.

Particular attention is given to encouraging and sustaining a smooth process of international collaboration between the Adriatic Sea coastal countries in fishery management, planning and implementation. Consideration is also given to strengthening technical coordination between the national fishery research institutes and administrations, as well as between them, the fishery organizations and the other relevant stakeholders of the Adriatic countries.

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ABSTRACT

The first meeting of the Adriamed Working Group (WG) on the Definition of Priority Topics Related to Small Pelagic Resources of the Adriatic Sea was held in Split, Croatia on the 12th and 13th October 2000. The meeting was attended by experts from Albania, Croatia, Italy and Slovenia. In line with the Project aim of strengthening joint research and regional management of shared stocks of the Adriatic Sea, the WG focused on small pelagic resources by identifying the most relevant issues and consequently proposing and formulating specific activities to be implemented within the cooperative framework of the Adriamed Project. The first objective was the evaluation of current knowledge on shared small pelagic fish stocks including the distribution pattern of the species, the state of fishery exploitation and how much information is at present available on these resources. The WG agreed on the role of the analysis of the genetic structure of fish and invertebrate populations in providing information on geographical limits of stocks and gene flow among sub-populations. Following the discussion the list of small pelagic species whose stocks are shared was prepared on the basis of the WG participants experience and was based on bio-economic considerations. The need for the joint preparation of a synopsis on current knowledge on the main commercial small pelagic species of the Adriatic was evaluated. The utility and importance of an up-to-date biological synopsis, reviewing current knowledge on the species concerned, was recognised with priority being given to *Engraulis encrasicolus* and *Sardina pilchardus*. The WG was briefed on the existing knowledge available in each Adriatic country concerning relationships between small pelagics and environment: the need of identifying the relationships between life cycles of small pelagic species and environmental characteristics of the Adriatic Sea system was discussed. Nine support papers were discussed and are included in this report.

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Report of the first meeting of the Working Group on the definition of priority topics related to small pelagic resources of the Adriatic Sea

Split, Croatia 12th – 13th October 2000

Opening of the meeting and election of the Chairman (Agenda Item n. 1)

1. The first meeting of the Adriamed Working Group (henceforth WG) on the “Definition of Priority Topics Related to Small Pelagic Resources of the Adriatic Sea” was held at the Institute of Oceanography and Fisheries (IOF), Split, Croatia on 12th and 13th October 2000.
2. Present at the meeting were experts from Albania, Croatia, Italy and Slovenia, who came from the national institutes indicated by the countries, as well as a representative of the Croatian National Marine Fisheries Inspectorate. Adriamed Project staff constituted the Secretariat. The list of participants is given in Annex A of this report.
3. The meeting was opened and the participants welcomed by the Director of the host institute, Dr Ivona Marasović. The Director took the opportunity to recall that the Institute is one of the most established centres of its kind in the Mediterranean area founded seventy years ago in 1930. The main activities of the Institute were detailed together with the core disciplines (oceanography, fish population dynamics, ichthyology, marine ecology, experimental aquaculture) dealt with at the seat in Split and at the subsidiary centre in Dubrovnik. Past activity and relevant technical courses were briefly described to the WG as well as plans for the future.
4. The floor was then given to the Coordinator of the Adriamed Project who briefly introduced the background and aims of this WG. The Project Coordinator informed the experts present that this meeting was part of a series of activities which had been proposed and outlined in occasion of the Adriamed Coordination Committee in March 2000. Reference was also made to the positive outcome of the first meeting of the Working Group on the Definition of Priority Topics Related to Shared Demersal Resources of the Adriatic Sea, held in Fano, Italy in July 2000 (Adriamed Technical Document “Priority topics related to shared demersal fishery resources of the Adriatic Sea”, GCP/RER/010/ITA/TD-02).
5. In line with the Project aim of strengthening joint research and regional management of shared stocks of the Adriatic Sea, it was remarked that the WG should mainly focus on small pelagic resources by identifying the most relevant issues and consequently proposing and formulating specific activities to be implemented within the cooperative framework of the Adriamed Project. Reference was also made to the recommendations of the Scientific Advisory Committee (SAC) of the General Fisheries Commission of the Mediterranean (GFCM), which encourage the setting up of regional projects with the aim of improving the knowledge and expertise in the area.

6. Prof. Stjepan Jukić-Peladić was nominated to chair the meeting and accepted this role. The Chairman referred to the agenda proposed by the Secretariat and asked the participants for any observations or changes. The Agenda was adopted with no changes (Annex B).

Objectives of the Working group (Agenda Item n. 2)

7. The objectives of the WG, proposed under point 2 of *FAO-Adriamed WGSP/01/info 1* (Annex C), were introduced by the Secretariat. It was stressed that the first objective is the evaluation of current knowledge on shared small pelagic fish stocks including the distribution pattern of the species, the state of fishery exploitation and how much information is at present available on these resources. It was added that the concrete output of the WG should be the identification of priority activities to be dealt within the Project framework and possibly for the most part implemented by Adriamed. It was highlighted that during the first meeting of the Coordination Committee the project components were discussed and approved, including the AdriaSHARE (Adriatic Sea Shared Stocks) component which is directly related to the shared resources of the Adriatic Sea (Adriamed document “Report of the First Meeting of the Adriamed Coordination Committee”, GCP/RER/010/ITA/TD-01, refers). Further reference was made to the Working Group on shared demersal resources held in Fano, July 2000, and the WG was informed that this and the current meeting would have similar intent and outline.

Listing of shared stocks by management unit (Agenda Item n. 3)

8. The WG passed to the identification of and agreement on the small pelagic species whose stocks are shared by the fishing fleets of at least two countries. It was noted that many pelagic species, if not all, are shared in the Northern and Central Adriatic (geographical management unit 37.2.1.a), whereas in the Southern Adriatic (37.2.1.b) all but the sprat (*Sprattus sprattus*) could be considered common stocks to the coastal states and potentially shared stocks, should industrial pelagic fishery resume in Albania.
9. The WG considered that to ascertain the biological unity of stocks is highly relevant when dealing with shared resources. The issue of the genetic structure of the stock was raised and it was brought to the attention of the WG that a stock identified as unit and also as shared stock theoretically should show genetic homogeneity. Therefore, it would be desirable to undertake genetic analysis of the species concerned in order to ascertain the genetic unity and which sub stocks, if any, are present in the Adriatic basin this information would then be made available to the scientific community. The WG agreed on the role of the analysis of the genetic structure of fish and invertebrate populations in providing information on geographical limits of stocks and gene flow among sub-populations. It was noted that currently there is limited knowledge on small pelagic species of the Adriatic.

10. Research on the genetic analysis of the stock structure has mostly focused on the Adriatic sardines (*Sardina pilchardus*, also commonly known as European pilchard) and anchovies (*Engraulis encrasicolus*). A recent study on sardines using molecular genetic markers (mitochondrial DNA, mtDNA) showed that Adriatic sardines should be considered as a near-panmictic population with no fragmented sub-populations. These findings contradict the previously proposed sub-division (based on the analysis of lifecycle, serological and meristic features) of the sardines into two geographic sub-populations, occurring north and south of Pomo pit, with reduced gene flow.
11. In the case of *E. encrasicolus*, the information currently available based on both molecular genetic (electrophoretic analysis) and morpho-meristic analysis would indicate a differentiation between samples from shallow coastal areas in the North-Western Adriatic and those from offshore, deeper water of the Central and the Southern Adriatic. However, it must also be observed that, despite differences in the length distributions from inshore and offshore waters of the central part of the Eastern Adriatic, no significant difference was found in the vertebral number of the sampled anchovies. This might be considered as support to the argument for homogeneity of the anchovy population in this part of the Adriatic.
12. It was pointed out that, in order to obtain sound evidence on the genetic structure of pelagic species stocks of the Adriatic Sea, coherent sampling and methods of analysis are desirable. Too often results are conditioned by different sampling and analysis procedures. It was considered necessary to ensure geographically representative sampling coverage and the standardization of data collection and techniques employed when undertaking genetic research.
13. The WG also considered the necessity to distinguish between stocks which are commercially exploited by more than one country and those which just move from the waters of one country to those of another. This problem was raised due to the contrasting emphasis given by different countries to the commercial importance and appreciation of a particular species. Furthermore, future market trends and demand could change thus species which are not appreciated at present could gain more commercial consequence. For this reason the WG considered the value of carrying out sufficient research on species which are biologically significant, in order to have suitable data in the case of an inversion of market tendencies. It would then be desirable that the list of common small pelagic resources be separated into economically and biologically significant species.
14. However, it was noted that there might be some species which are economically important but are only found and fished in coastal waters and thus cannot be considered shared stocks. Concerning this aspect, reference was made to discussion at the recent 25th session of the GFCM in Malta where strategic species were considered firstly those shared by different fleets whereas some such coastal species were judged more specifically relevant to local artisanal fishery.
15. The WG considered several species whose stocks are shared by the fishing fleets of at least two countries. The need for two lists was confirmed, one covering the highest

priority species, the second being a list of species of secondary importance. The list of small pelagic species whose stocks are shared was prepared on the basis of the experience of the WG participants and was based on bio-economic considerations. Following the discussion it was agreed that Group A list should cover high priority, commercially important species, those which have greater economic value for the basin, while Group B species were regarded as of secondary commercial relevance, although, in some cases, of remarkable local importance.

16. The Mediterranean horse mackerel (*Trachurus mediterraneus*) and the Atlantic horse mackerel (*T. trachurus*) are semi-pelagic species whose suitability to be added in the present list was discussed. It was decided that these species are common catch of the demersal trawl fishery and therefore their inclusion in the Group B list of shared demersal fishery resources (GCP/RER/010/ITA/TD-02 refers) of the Adriatic Sea was considered appropriate by the WG.
17. The WG agreed on a final list of species whose stocks should be regarded as shared by the Adriatic Sea countries which is given in Annex D of this report.

Status of current knowledge on the ecology and population dynamics of main shared stocks (Agenda Item n. 4)

18. The Chairman introduced this point of the agenda. An overview was presented of the biology and population dynamics of the most common small pelagic species occurring in Croatian waters. Following the discussion it was noted that while the biological parameters are similar around the basin, there is a lack of knowledge regarding larval and juvenile (post larval) ecology of small pelagics in the Adriatic Sea. The implications of this aspect for the investigation of the stock/recruitment relationship were underlined. It was pointed out that there is a difference between the sampling strategies of Croatian and Italian researchers in particular. Due to the importance of estuaries as nursery areas, and also to monitor year class strength, in Croatia monthly sampling effort is concentrated on these critical habitats.
19. Reference was made to a bibliographic review of Adriatic pelagic fish which was issued in 1994 and included works published until 1990. The WG deemed that it would be important to update this bibliography with the material produced during the last decade. It was also observed that it would be extremely useful to make more accessible, or give wider distribution to, the so-called grey literature which often includes very valuable information.
20. The discussion on gaps in information continued with the Chairman asking the WG to express the position of each country. In Slovenia the most recent research in the field was carried out in the 1960s and 1970s and concerned the migration of sardines and sprats. A brief note on research and fisheries for small pelagics in Slovenia was presented by Marčeta (this report).

21. The WG was informed that in Albania in recent years there has been negligible activity in the field of pelagic resources research. This is to a great extent linked to the collapse during the 1990s of the national pelagic fishery industrial. Some pre-1990 statistics were given and it was accepted that there is a need to update Albanian fishery data and to gain a more comprehensive knowledge. Past and present small pelagic fishery and research in Albania is outlined in Kapedani (this report).
22. The Secretariat informed the WG that the Project would be willing to support a bibliographical review on the status of knowledge on the main species (*i.e.* Group A species) and invited the WG to agree and propose a course of action.
23. An overview was presented of the stock assessment work carried out on small pelagics by the Italian IRPEM-CNR (Marine Fisheries Research Institute-National Research Council) of Ancona. The statistical (catch and effort) and biological data collection system was first established in 1975 at selected landing ports along the western coast of the Northern Adriatic and of the Central Adriatic (as far as Ancona). Since 1984 the sampling network has been extended South of Ancona (as far as Vieste) covering all the western coast of the Northern and Central basins thus including 15 fishing ports (at four of which biological sampling was performed). Some attempt was also made to extend the data collection to the Southern Adriatic, but due to the organizational characteristics of the local pelagic fishery, this turned out to be economically unfeasible. Moreover, since 1993 an on-board observer programme was set up aiming, among other things, to assess the catch discards; also data collection using vessel logbooks is being tentatively implemented. Information on the data collection scheme and results from the holistic (DeLury depletion model) and analytical (Virtual Population Analysis, VPA, and Length Cohort Analysis, LCA) assessment models used for routine stock assessment is given in Cingolani *et al.* (this report).
24. Small pelagics biomass assessments has been performed by Croatian researchers from IOF employing VPA and LCA analysis, holistic models, eggs and larvae survey and acoustic surveys (Sinovčić, this report). Assessment work mainly focused on sardine stock and to a lesser extent on anchovy and it was carried out from the 1960s but not regularly and not using all the mentioned methods (Sinovčić, this report).
25. With reference to paragraph 23, the WG observed that the assessment results presented are the outcome of relatively costly research in terms of data collection and personnel. Unfortunately, this implies that it is not an option presently available to all countries in the basin. The potential expansion of similar commercial catch sampling, and of consequent stock assessment capabilities to the rest of the region was suggested. As a consequence the WG would like to see all available information united and historic time series rebuilt, leading on to joint research to be carried out in the future. The Secretariat noted the need for the review to include all historical data on record, not just the current situation.
26. IRPEM-CNR also carries out combined hydro-acoustic and mid-water pelagic trawling surveys to estimate small pelagics biomass and distribution pattern. Echo-surveys have

been implemented since 1976 in the Northern Adriatic and since 1987 in the Central and Southern Adriatic. Survey details and results integrated with sea surface temperature obtained from remote sensing data are outlined in Azzali and Luna, this report.

27. The WG agreed with the observations of the authors of the aforementioned support paper who indicated the geographical and temporal sampling coverage as the main limiting factors of the acoustic surveys carried out so far; in approximate terms, only the western half of the Adriatic Sea could be monitored and only once a year. Obviously, this drastically reduces the relevance of the information obtained to the basin as a whole, and to the entire year cycle. Nevertheless, the WG recognised the value of such research and observed the need to extend this to the rest of the region, possibly with a single vessel and a multinational scientific crew.
28. The Director of the Marine Biology Laboratory of Bari, in his capacity as national coordinator for research programmes on small pelagic stocks, (funded by the Italian Ministry of Agriculture and Forestry Policies), informed the WG on the on-going activities. The relevance of pelagic fishery for the Italian fishing sector was highlighted and an overview on scientific research accomplishments was presented with special attention to the Adriatic Sea. Current and past estimates of biomass particularly of *E. encrasicolus* and *S. pilchardus* were discussed (Marano, this report). It was noted that higher biomass density of both species are found in the Northern and Central Adriatic with sardine being the most abundant species. Favourable trophic factors, *i.e.* high nutrient concentration upon which phyto-zooplankton abundance are based, and abiotic parameters such temperature and salinity were indicated among the causes determining the relatively high abundance of anchovy and sardine in the Northern and Central Adriatic.
29. Results from a recent survey on relative abundance pattern for anchovy eggs (n/m^2), carried out in August 2000 by the Marine Biology and Fishery Laboratory of Fano in international and Italian waters, were distributed to the participants (Piccinetti, this report).
30. It was brought to the attention of the WG that three independent stock assessment methods are employed in Italy by the different research groups. Biomass estimates are therefore obtained from population dynamics methods such as Virtual Population Analysis or Length Cohort Analysis, and DeLury method (Cingolani *et al.*, this report), eggs and larvae survey through batch fecundity and daily egg production methods, and acoustic survey (Marano, this report). Independent biomass estimates for both anchovies and sardines are available and there seems to be general agreement on the resulting abundance trends while differences in biomass estimates may be marked.

Relationships between small pelagics and the environment in the Adriatic Sea (Agenda Item n. 5)

31. The WG was asked to consider the nowadays central tenet that understanding the mechanisms that cause abundance fluctuations of small pelagic stocks is of primary importance to the management of these fisheries. Correlations between environmental variables and small pelagic fish abundance and distribution are being studied in several seas and it would appear that for some clupeid species environmentally-induced recruitment variability can be more important than changes in fishing mortality.
32. The WG was briefed on the existing knowledge available in each Adriatic country concerning relationships between small pelagics and environment. It was reported that in Slovenia there is not much scientific data on the relationship between pelagic species and their environment although some links have been investigated. Phytoplankton and zooplankton samples are collected every month however no clear link has been established so far between these and the small pelagic resources. The WG was made aware that currently in Albania there is almost a total lack of research in this area, the only relevant studies being those of chemical and toxin levels in the sea for coastal water classification purposes mainly for bivalve mollusc fisheries.
33. The main aim of the IOF of Split since 1950, particularly from 1965 to 1988, was to study the links between environment and fish stocks with a multidisciplinary approach. A considerable amount of research work into this aspect was carried out and prediction of capture based on environmental factors has taken place. The analysis of available abiotic and biotic information indicated a positive relation between primary productivity and landings of small pelagics. For the period 1965-1988 the relationships between abiotic (*i.e.* temperature, salinity and oxygen) and biotic (*i.e.* primary production) variables concerning relative abundance of sardines (CPUE) were investigated (Sinovčić, this report). Significant correlations were found between CPUE and primary production (positive), and temperature (negative), while the link to salinity appeared positive although not always significant. No correlation was found with oxygen concentration. Since 1988 less effort has been devoted to this topic and research has addressed issues such as population dynamics and exploitation status of small pelagics, investigations in estuarine areas with respect to the high occurrence of juvenile small pelagic fish species as well as coastal zone management and eutrophication.
34. The WG deliberated the problems inherent in an effective study of the connection between pelagic species and their environment. While the importance of such research was recognised, the importance of having available long (decadal) time series in order to detect possible cause-effect relations was also noted.
35. It was brought to the attention of the WG that at IRPEM in Ancona there is an historical data set (from the early 1900s to 1981) concerning the whole Adriatic Sea which is available to the scientific community. The database consists of records (*e.g.* temperature, oxygen and salinity) from about 9000 coastal and offshore hydrological stations, it is called ATOS (Adriatic Temperature Oxygen and Salinity) and is one of the products of

the EU project MERMAIDS (Mediterranean Resolving Modelling And InterDisciplinary Studies). Since 1980 the data collection and measurement methodology has changed, a new database, starting from 1981 up to the present day, is in progress. IRPEM, in collaboration with other Institutes, is working to continue and expand this database in order to give ever more reliable data to the scientific community. The WG agreed on the importance of the current effort of IRPEM to extend these databases and also to take into consideration coastal hydrological stations (Artegiani, this report).

36. At present the reasons for the 1987 anchovy stock collapse (also known as “the anchovy crisis”) are being studied by IRPEM as part of the on-going Italian CNR/MURST SINAPSI project (Seasonal, INterannual and decAdal variability of the atmosPHERE, oceanS and related marIne ecosystems). In this context satellite data of sea surface temperature were shown although it was pointed out that this information is representative only for the Adriatic surface layer as the sea is characterised by highly stratified waters especially in summer. Experts from IOF drew the WG’s attention to further papers produced on the influence of temperature on small pelagic species as well as other environmental factors such as wind and the consequent mixing of waters, years of higher winds creating greater productivity in successive seasons.
37. It was commented that in the case of Slovene pelagic fishery which depends on the migratory behaviour of small pelagic species, the understanding of the links between environmental parameters and fish behaviour and production is a priority topic. Consequently, the involvement of Slovene research, at regional level in this area of study, is of great interest.
38. The WG considered the recent development of concepts, hypotheses and the progress made on the understanding of the mechanisms governing the environmental effects on fish stock productivity. The non-linearity of some fishery-environment processes is being elucidated. For instance, the Optimal Environmental Window (OEW) hypothesis suggests that a dome shaped relationship exists between recruitment success and coastal wind-induced upwelling intensity, where the former is optimal in moderate upwellings. It would appear that in accordance with OEW the favourable conditions for small pelagic fish recruitment success in upwelling areas occur at wind speed range of 5-6 m/s. It is worth noting that several studies carried out in different areas of the world (mostly in tropical or sub-tropical upwelling areas) showed a dome shaped relationship between small pelagic stock recruitment and upwelling intensity in agreement with the OEW hypothesis.
39. The OEW hypothesis and evidence appears to support the “fundamental triad” framework composed of three physical processes whose balance is believed to determine small pelagic fish productivity: *enrichment* leading to zooplankton production; *concentration* which increases food availability to fish larvae; and *retention* thus keeping the juvenile fish in favourable nursery habitats. The Adriatic Sea has been identified as one of the areas within the Mediterranean where processes of the triad configuration could play an important role to determine potentially favourable reproductive habitats for small pelagics.

40. It was remarked that research on the links between environmental variables and small pelagic stock productivity must necessarily be of multidisciplinary nature, based on the availability of cooperatively prepared common databases on environment and fishery resources of the region concerned. The WG agreed that further study of this aspect and especially the reasons for changes in production would be of interest to all Adriatic countries, whatever the species concerned. The WG thus affirmed that it would be important, within the Adriamed Project framework, to take into due consideration the idea of preparing and making available a regional inventory of existing time series and a subsequent database for the use of regional scientists.
41. Moreover, the importance of currents, the dynamics and circulation of the Adriatic water masses and upwelling were also discussed by the WG and it was wondered if Adriamed could have the task of collecting meteorological data from the open sea oil platforms. These data are at present unavailable to the research institutes.
42. A discussion ensued on the extent to which the Adriamed Project can intervene in this difficult area. It was stressed that the first priority is to understand how to proceed in finding links between small pelagics species and the environment, potentially just focussing on some of the parameters mentioned so far in the quest to improve scientific research, the risk being that of overlooking the determinant mechanisms because of the chain effects of related variables. A gradual, hierarchical approach should therefore be pursued. It was agreed by the WG that the aforementioned time series inventory is fundamental, further gaps were identified in the dynamics of the processes involved and the environmental parameters which condition recruitment. Further comment was made on the importance of the different ecosystem scale (*e.g.* mesoscale) to consider which may be the appropriate level of analysis in the case of the Adriatic.
43. The Chairman further summarised that regional data sets need to be harmonised and possibly integrated and observed that the whole chain made by environment, fish productivity and market (*i.e.* socio-economic factors and consequences) should be considered without overlooking this latter component. The Secretariat underlined the fact that the Project is not so ambitious as to give answer to the scientific issues brought up in this item of the Agenda in a short time, instead the objective is that of catalysing collaboration between each country's researchers. The Project should be used to find approaches and to retrieve information parameters which scientists can then decide how and indeed if to use.

Review of identified critical areas for shared stocks (Agenda Item n. 6)

44. The WG agreed that in general shallow coastal areas within few meters of bottom depth are relevant for juveniles of *S. pilchardus* and *E. encrasicolus*, particularly for the first sardines along the western coast and, on both coasts, river mouths and estuaries are important habitats during the early life stage.

45. However, it was brought to the attention of the WG that in the Southern Adriatic an important, localised critical area for the high concentration in winter months of young sardines is known to be the Gulf of Manfredonia on the west coast, where local fishery has developed.
46. Under the present level of exploitation and indications from stock assessment work, the WG did not identify particular needs to recommend or formulate new specific management measures to control fishing mortality in the reproductive habitats of sardine and anchovy.

Dynamics of fishery exploitation exerted by fishing fleet/gear (Agenda Item n. 7)

47. Adriatic small pelagic fishery can be considered as multigear mostly relying on the use of pelagic pair trawl and purse seine operated at night using light attraction. The first is the common gear mainly used in the Northern Adriatic while the second is employed in the Central and Southern Adriatic. A description of west coast based fishery is illustrated in Marano, (this report) and all Adriatic regional landing trends from nominal GFCM statistics are also given in Annex F of the Adriamed Technical Document GCP/RER/010/ITA/TD-01.
48. The WG appreciated the work, the amount of valuable information and the results obtained through the IRPEM data collection network. The extension of a similar data collection system was also considered very important and could be organised as a pilot activity coordinated by Adriamed, including some selected ports along the Eastern coast.
49. The different data collection strategies (sampling at landing site, vessel logbook and on-board observer) employed by IRPEM were described and discussed. The use of logbooks was reported as difficult due to the incomplete cooperation of fishermen. However, logbook based research can be of use, especially when evaluating reasons for changes in productivity. With suitable follow-up this system can lead to greater communication between researchers and fishers. The on-board observer programme has proved very useful to obtain information on fishing fleet behaviour and to provide data on fish discarding at sea to upgrade the landed catch.
50. Competition between pelagic trawl and purse seine targeting the same species in the same area and, particularly, between local and non-Adriatic fishing fleets was indicated as an area of conflict. Although local resource users fear that current levels of fishing exploitation may not be sustainable, the main reason for conflict in Italy does not concern the competition for resources the access to local markets where the price of small pelagic fish at landing is relatively high and therefore attractive. This was reported to be one of the effects of the “local quota system” established and pursued by producer associations at some fishing ports of the high and middle Adriatic.
51. The WG observed that with the present sardine and anchovy stock size a fishing effort increase up to 25% of the present could be sustainable as estimates of fishing mortality

and exploitation rates are relatively low. Unlike other areas of the Mediterranean Sea, the WG agreed that in the Adriatic Sea no signs of recruitment overfishing for both *S. pilchardus* and *E. encrasicolus* were detected. At the same time, however, it was also underlined that expansion and contraction periods are characteristic of clupeid species and that natural changes in the stock size are often caused by environmental factors which affect recruitment success. The negative effects of either environmental variables or fishery overexploitation have the same consequences as recruitment overfishing. The risk is that when recruitment declines so does the subsequent stock and if the fishing effort remains the same then recruitment overfishing takes place. Collapses due to recruitment overfishing have often been associated with transient environmental changes.

Proposal for synopsis of the main Adriatic species whose stocks are shared (Agenda item n. 8)

52. The need was evaluated for the joint preparation of a synopsis on current knowledge on the main commercial small pelagic species of the Adriatic. The utility and importance of an updated biological synopsis, reviewing current knowledge on the species concerned, was recognised with priority being given to *E. encrasicolus* and *S. pilchardus*. The WG also agreed that it would be particularly useful to take into consideration information from the so-called grey literature which is often very relevant but poorly circulated. This work should be carried out by highly experienced scientists assisted by colleagues from countries participating in the Project. Therefore, Adriamed was asked to organise and coordinate the preparation of the synopses.
53. The Secretariat made the WG aware that a similar task was also proposed by the Working Group on shared demersal fishery resources and therefore it was anticipated that the preparation of these synopses will be carried out within the same framework of activity.

Proposal for specific activities to be implemented within the Adriamed framework (Agenda item n. 9)

54. The Chairman introduced this item of the Agenda referring to and summarising the outcome of the discussion on the various topics and the interest expressed by the WG participating experts. The WG proceeded to propose several activities, previously given priority, which are detailed hereafter, the recommendations and decisions on which follow under Agenda Item 10.
55. The WG recommended that the genetic analysis of the stock structure proposed during the Working Group on shared demersal resources (GCP/RER/010/ITA/TD-02, point 76 refers) be extended to include *S. pilchardus*, *E. encrasicolus* and possibly *S. sprattus*. The Secretariat noted that this would also serve as supplementary tool for the identification of the Adriatic Sea operational units and expected this work will be cooperatively executed by the University of Bologna and the National Institute of Biology of Ljubljana.

56. Concerning the setting-up of a common small pelagic catch statistics and biological data collection system, it was agreed to have a more definite proposal in order to understand the costs involved. Also, it was pointed out that efforts should be devoted to building common historical time series using the statistics which may be available in the countries participating in the Project. IRPEM staff accepted the task of preparing this proposal in collaboration with the scientific counterparts of the Albanian Fishery Directorate, the Croatian Institute of Oceanography and Fisheries and the Slovene National Institute of Biology.
57. Considering that acoustic survey to appraise small pelagic stocks has never been carried out over the whole Adriatic, thus implying serious limits in the past biomass estimates and distribution patterns, a joint proposal for the first-ever echo survey will be finalised by IRPEM in accordance with the Institute of Oceanography and Fisheries of Split, the Fishery Research Institute of Dürres and the National Institute of Biology of Ljubljana.
58. The WG proposed the creation of an up to date bibliography and synopsis of the small pelagic species of commercial consequence as stated in paragraphs 50 and 51. The WG was informed by the Secretariat of the preparation of a regional inventory of the existing historical time series and data sets of abiotic and biotic variables related to Adriatic fisheries production. Currently, such activity is being undertaken by the Project in Albania, Slovenia and Croatia. IRPEM agreed to undertake the creation of such an inventory of available time series of abiotic and biotic variables for Italy which would then be integrated with that of the other countries. The WG recognised the short-term need for an inventory of regional databanks in order to understand what exists.
59. Some WG participants expressed the need for something like a forum which might be supported or organized by Adriamed, where the latest research on stock assessment could be introduced and discussed. Such a forum would make new data available to all scientists in the region. A solution put forward might be the possibility of Adriamed producing a periodical technical publication on recent developments. Alternatively, an *ad hoc* Technical Consultation on stock assessment in the Adriatic Sea could be set up in order to discuss and disseminate such information to the scientific community in the area. It was observed that the last similar technical consultation took place 13 years ago in 1987.
60. The WG considered the issue of training needs and of national capacity building and resolved to endorse and to insert in this report the relevant sections of the “Report of the First Meeting of the Working Group on the Definition of Priority Topics Related to Shared Demersal Resources of the Adriatic Sea”, issued by the Adriamed Project in September 2000. The paragraphs 61-65 below are from the aforementioned report and were agreed by the WG.
61. *“The WG deliberated at length the various needs and possible activities where the training of experts is concerned. The members of the WG gave their opinions according to the specific needs of each country as follows:*

- 61.1 *Albania: the WG was informed that in Albania the most significant problem is the difficulty of attracting young people to a sector in which experts are lacking. The first suggestion to resolve this was the reorganisation of existing staff through short term specialised courses. The elaboration of data could be a priority subject, as the existing data are not fully utilised because staff are lacking modern methods and are not able to use the computer facilities and applications available properly. The second idea was that the University of Tirana could select young students who would then be given specific training, in this way young people would receive vocational tuition in a sector and would hopefully be disinclined to leave the country given the economic situation in Albania. The WG was informed that the EU-PHARE project would soon be providing some financial support to the Fishery Research Institute of Dürres which could in part be used for training of staff.*
- 61.2 *Slovenia: the WG was advised that, due to the relatively low economic value of fisheries as a whole in Slovenia, the sector is understaffed and funding is low. There is not so much the problem of training existing staff as attracting and supporting new experts. The need for investment in human resources in Slovenia was stressed. It was considered important to create awareness of this need and of the Adriamed Project activities within the universities of Slovenia, this could lead to the reinforcement of the fishery sector through other areas such as the environment and economics. The possibility that experts could be trained in the context of the Working Group on Socio-Economic Indicators was also put forward.*
- 61.3 *Croatia: the WG was informed that there is a certain tradition in Croatia regarding the formation of experts for scientific institutes although there are some gaps in a few specific areas of expertise. The utility of FAO training courses is agreed, especially those in fisheries and natural resources management. A specific suggestion was courses in stock assessment, a kind of study which is lacking at present. The need to improve the coordination between the fishery administration and research institutes was expressed.*
- 61.4 *Italy: one of the main problems in Italy was defined as the need to ensure the comprehensive training of experts due to the complexity of the fishery sector, especially where practical training is concerned. Another issue of concern, although not related to training needs, is the difficulty to keep young researchers involved in the field of fishery sciences.*
62. *The WG recommended the standardisation of training around the Adriatic, in particular methodology and practical training, such courses could also include the coordination of the use of analytical tools and programmes used by researchers. The WG also suggested across the board training for everyone from administrators to port authorities and fishery inspectors in order to help standardise information and improve communication and collaboration. This would also assist the work of institutes which are often limited by the incomprehension of those in authority. An example was made of the solution present in Italy where communication between researchers and Government is assisted by the presence of a national scientific Coordination Committee. However, doubts were*

expressed as to Adriamed's mandate and the possibility of topical problem solving and involvement.

63. *The Secretariat requested that the WG come up with specific proposals for training programmes with precise indications of their requirements. The WG was also told that the Project would communicate the existence of FAO courses on relevant topics.*
64. *In order to strengthen the scientific cooperation and with reference to the need to cooperatively analyse the available scientific information on the shared stocks, it was proposed to hold, within Adriamed framework, joint sessions of data analysis with the assistance of highly qualified experienced scientists. This activity could be envisaged as a sort of regional on-the-job training workshop on fish population dynamics and stock assessment organised in several theoretical and practical sessions using the original data available from around the Adriatic.*
65. *The WG agreed that such a proposal as this would lead to the common application of analytical tools around the basin and would also provide critical analysis of the existing data that otherwise might not be fully exploited. The possibility of each country providing a few experts, who would undergo data elaboration training was judged favourably. Therefore, the Adriamed staff was asked to formulate and finalise, with the assistance of WG members, a detailed activity proposal.”*
66. The WG made the following comments regarding the paragraphs 61-65 inserted: the Albanian experts agreed that in recent years no further training in the fishery sector has taken place and view a specific training course for fishers as particularly relevant. The WG agreed on the need to hold discussions with fishers and their associations in order to understand their requirements fully and at the same time to inform them of the activities carried out by research centres. The WG recommended both aspects be covered by the project: a practical training/education and forum/seminar based discussion and exchange of ideas. The WG also emphasized the difficulty expressed in point 61.1 of stimulating young people to enter the sector, both at commercial and researcher level; training was proposed as a way of overcoming this difficulty.
67. The Secretariat advised the WG that while it agreed that across the board training is considered necessary, Project activity would first deal with the areas of greatest immediate need, tackling priorities according to the country. In this case it was highlighted that the priority is training in all areas of the fishery sector in Albania. The WG was also informed that it is the Project's intention to deal with the subject of capacity building at length with the fishery associations around the basin.

Work programme and schedule (Agenda Item n. 10)

68. The WG approved the preliminary work proposition regarding small pelagic species detailed in Agenda Item 9. The deadline for plans to reach Project Headquarters was agreed, the experts nominated will provide written proposals by 10th November 2000 in

order for the Project to put them before the Coordination Committee (22nd – 23rd November) for opinion and orientation.

69. The secretariat noted the WG's approval of the previous proposals regarding training needs and national capacity building.

Other matters (Agenda Item n. 11)

70. The WG was informed that the issue of the availability of common digital Adriatic Sea maps to be used by each country had been addressed by the Project and the General Bathymetric Chart of the Oceans (GEBCO) Digital Atlas purchased, four of which will be available at each country's focal point. The WG expressed its gratitude, remarking that although the scale of GEBCO is rather large, it still remains one of the best existing digital bathymetric charts. Adriamed will continue to consider this issue looking into possible other ways to obtain available suitable digital maps.
71. Following a request of the WG, the Secretariat communicated that training session on Geographical Information System (GIS) application to marine and fishery data could be organised in the future starting first from a basic course on GIS.

Date and venue of next meeting (Agenda Item n. 12)

72. The WG agreed that the next meeting would take place within six months by April 2001, however it was suggested that it could be opportune to hold the Adriamed WG meeting before the GFCM-SAC sub committee meeting on stock assessment which will take place in March 2001.
73. The Director of the LBMB proposed that the second meeting of the Adriamed Working Group on small pelagic fishery resources of the Adriatic Sea should be held in Bari, Italy. The WG accepted this offer.
74. The Chairman thanked the participants and closed the meeting.

Annex A: List of Participants

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Annex B: Agenda

1. Opening of the meeting and election of the Chairman
2. Objectives of the Working Group
3. Listing of shared stocks by management units
4. Status of current knowledge on the ecology and population dynamics of main shared stocks
5. Relationships between small pelagics and the environment in the Adriatic Sea
6. Review of identified critical areas for shared stocks
7. Dynamics of fishery exploitation exerted by fishing fleets/gear
8. Proposal for a synopsis of the main Adriatic species whose stocks are shared
9. Proposal for specific activities to be implemented within Adriamed framework
10. Work programme and time schedule
11. Other matters
12. Date and venue of next meeting

Annex C: *FAO-Adriamed WGD/01/info1*

1st Meeting of the Working Group on the definition of priority topics related to shared small pelagic resources of the Adriatic Sea

Split, Croatia 12-13 October 2000

1. Background of the Project Component

In line with the Project aim of strengthening joint research and regional management of shared fishery resources, this Working Group (WG) should mainly focus on small pelagic fish resources by identifying the most relevant issues and consequently formulating specific activities to be implemented within the cooperative framework of the Adriamed Project.

1.1 Aims

The main aim is the strengthening of regional scientific cooperation through the organization of an international WG of experts on priority topics related to the shared small pelagic resources of the Adriatic Sea. Most commercial small pelagic species constitute shared stocks. The comprehension of the pattern by which stocks are shared between countries is a central issue. Therefore, it would be desirable to produce and assemble evidence on the nature of shared stocks, which may depend on the movement pattern and, on a practical level, the interaction with fishing fleet/gear.

1.2 Organizational approach

An *ad hoc* WG whose activity will be organised in several sessions. The WG will consist of regional experts and it will be open to external, qualified contributions. It will be coordinated by an experienced scientist from the region assisted by the Adriamed staff. Initially the WG will consider a list of target commercial species which are thought to constitute shared stocks. Consequently, should the available scientific evidence be uncertain or insufficient, available information (e.g. research data, fishery statistics, etc.) from each country will be cooperatively used for analysis. Important gaps in the scientific knowledge of some shared stocks, which cannot be filled with the existing information, will be highlighted and research proposals drawn up.

1.3 Output

It is expected that from the WG activities an improved definition and assessment of commercially important shared stocks will be obtained through strengthened regional scientific cooperation. Proposals for joint research priorities will be elaborated where needed. Technical advice for cooperative fishery management of shared resources will be formulated.

2. Description and Objectives of the Working Group

2.1 Description

The WG is established within the so-called AdriaSHARE Project component (“Report of the 1st Meeting of the Adriamed Coordination Committee”, GCP/RER/010/ITA/TD-01, refers). The WG has the practical and operative objectives of:

- Considering the available information and knowledge on how these resources are shared between countries/fishing fleets;
- Reviewing and highlighting the gaps in the scientific knowledge of small pelagic stocks which are relevant for their management;
- Envisaging possible ways to achieve an improved understanding of the links between environmental variables and pelagic fishery production in the Adriatic Sea through regional scientific cooperation.
- Proposing activities of regional scientific cooperation to be carried out within the Adriamed framework.

2.2 Topics to be addressed by the Working Group

The following topics are proposed for consideration in the Agenda of the WG:

- Listing of target shared stocks/fisheries by Adriatic Sea Management Units;
- Status of the available knowledge on the ecology and population dynamics of the main shared stocks also with reference to their seasonal and spatial distribution pattern by size/age in territorial and international waters;
- Current identification of, and knowledge on, critical areas for spawning and recruitment of shared resources which may require the adoption of management measures;
- Dynamics of the fishery exploitation exerted by fishing fleets/gear of the countries sharing the resources;
- Knowledge of the relationships between life cycles of small pelagic species and environmental characteristics of the Adriatic Sea system;
- Justification for the preparation of a synopsis on the biology and fishery exploitation of the main shared species of the Adriatic Sea.

3. Output and Follow-up

The WG will identify the main and priority issues concerning the biological knowledge and fishery management aspects of the shared small pelagic stocks of the Adriatic Sea. Consequently, practical formulation of joint activities will be elaborated by the WG, inclusive of methodological approach, to be implemented by the Adriamed Project within its resources and mandate. The work programme for the future WG activities will be established. A report will be prepared by the Secretariat in cooperation with the nominated Chair of the meeting.

4. Participants

The WG will be attended by:

- Relevant Adriamed scientific counterparts from each country participating in the Project (Regional Experts)
- FAO-Adriamed Secretariat
- External qualified experts may also be invited

The Adriamed Project will support the attendance at the meeting of two nationals from each country; other participants on their own funds are welcomed.

5. Venue

Institute of Oceanography and Fisheries, Split (Croatia)

6. Date

12th - 13th October 2000

7. Working papers

A support paper, which will be included in the WG meeting final report, reviewing the status of each country's research and fishery on small pelagics is requested.

8. Organisation

The WG will be organised by the FAO–Adriamed Project and Institute of Oceanography and Fisheries, with the collaboration of the Adriamed's National Focal Points.

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Annex D: Relevant common species whose stocks are shared by at least two Adriatic countries.

●: common occurrence

○: scarce

blank: negligible

Species	Area of Occurrence		
Group A	Northern Adriatic	Central Adriatic	Southern Adriatic
Geographical Management Unit	37.2.1.a		37.2.2.b
<i>Engraulis encrasicolus</i>	●	●	●
<i>Sardina pilchardus</i>	●	●	●
<i>Sprattus sprattus</i>	●	○	
<i>Scomber scomber</i>	●	●	●

Species	Area of Occurrence		
Group B	Northern Adriatic	Central Adriatic	Southern Adriatic
Geographical Management Unit	37.2.1.a		37.2.2.b
<i>Scomber japonicus</i>	●	●	●
<i>Sardinella aurita</i>			●

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B. Adriamed Translations

Adriamed (Botim.). 2000. Përkthim në shqip i Kodit të FAO-s të Drejtimit për një Peshkim të Përgjegjshëm. GCP/RER/010/ITA/AT-01: 40f. (Albanian Translation of the FAO Code of Conduct for Responsible Fisheries, 1995).

Adriamed (Izdavac). 2000. Hrvatski prijevod FAO Kodeks Odgovornog Ribarstva. GCP/RER/010/ITA/AT-02: 38str. (Croatian Translation of the FAO Code of Conduct for Responsible Fisheries, 1995).

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Ungaro, N., Vrgoč, N., and Mannini, P. 2001. The biology and stock assessment of *Merluccius merluccius* (L.) in the Adriatic Sea: an historical review by geographical management units. Paper presented at the GFCM-SAC Working Group on Demersal Species (Tunis, 13th -16th March 2001). FAO-MiPAF Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea. GCP/RER/010/ITA/OP-03: 15 pp.

Adriamed. 2001. A preliminary contribution to the Mediterranean Operational Units. Paper presented at the GFCM-SAC Working Group on Operational Units (Ancona, 18th -19th March 2001). FAO-MiPAF Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea. GCP/RER/010/ITA/OP-04: 9 pp.